

Microbiologically Influenced Corrosion Inhibition (MICI) due to Bacterial Contamination

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Microbiologically influenced corrosion inhibition (MICI) has been observed for Al 2024, mild steel, and cartridge brass when an artificial seawater (AS) solution containing growth medium was contaminated by bacteria. In this case the test electrodes had been sterilized by immersion in ethanol, while the test cell had been sterilized in an autoclave. In tests in which all parts had been sterilized in an autoclave before assembly contamination did not occur and the corrosion behavior was similar to that obtained in AS without growth medium. Impedance data obtained in the contaminated solution clearly showed that pitting did not occur for Al 2024, while for mild steel and brass corrosion rates were greatly decreased. The analysis of the electrochemical noise (EN) data shown in Fig. 1 for Al 2024 demonstrated that the noise resistance $R_n = \sigma V / \sigma I$ had increased drastically in the contaminated solution in agreement with the polarization resistance R_p obtained by EIS (Fig. 1 a). The increase of R_n is mainly due to a decrease of the standard deviation σI , while the standard deviation σV of the potential fluctuations remained unchanged (Fig. 1 b). The slopes of the potential (m_V) and current (m_I) power spectral density (PSD) plots did not change due to bacterial contamination (Fig. 1 c). As indicated by the intercepts b_V and b_I of the PSD plots at $f = 1$ Hz, the current fluctuations had changed to lower levels in the contaminated solution, while the PSD plots for the potential fluctuations remained unchanged (Fig. 1 d). The skewness and kurtosis data for potential and current fluctuations were similar in both solutions and suggested normal distribution of the EN data. Similar results were obtained for mild steel and brass [1]. The localization index $LI = \sigma I / I_{rms}$ defined as the ratio of σI and the root mean square I_{rms} was close to zero in all cases. Preliminary results suggest that the main contaminant was a *bacillus* strain. Previous results had demonstrated that the presence of *bacillus subtilis* in AS prevented pitting of Al 2024 and reduced corrosion rates of mild steel and brass [2].

REFERENCES

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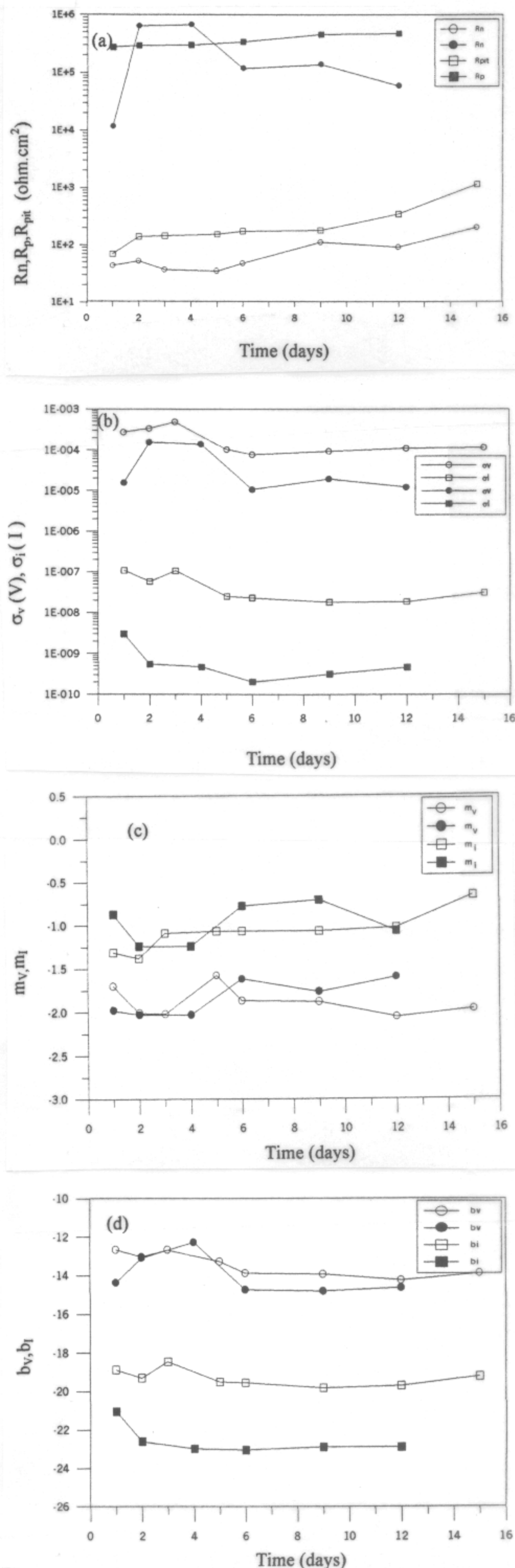


Fig. 1. Time dependence of R_p , R_{pit} and R_n (a), σ_V and σ_I (b), m_V and m_I (c), and b_V and b_I (d) for Al 2024 exposed to VNSS with and without growth medium; O, \square AS; \bullet , \blacksquare AS + growth medium.